Show sufficient work and clearly mark your answers. Each problem is worth 10 points.

1. A deposit of 500 accumulates to 625 after 2.5 years using a simple interest rate \( i \). Determine the accumulated value after 2.5 years if 500 is deposited into an account the earns an annual effective interest rate of \( i \).
   
   (A) 615
   (B) 620
   (C) 625
   (D) 630
   (E) 635

2. A deposit of \( X \) accumulates to 1000 after 6 years. During the first two years, interest is credited using a simple discount rate of 6%. During the second two-year period, interest is credited using a nominal interest rate of 6% compounded bi-annually. During the third two-year period, interest is credited using a force of interest \( \delta = 6\% \). Determine \( X \).
   
   (A) 697
   (B) 700
   (C) 702
   (D) 705
   (E) 707
3. Given a simple interest rate of 5%, determine the equivalent nominal discount rate, compounded semi-annually, for the second half of the first year.

   (A) 1.8%
   (B) 2.4%
   (C) 3.6%
   (D) 4.8%
   (E) 7.2%

4. Using an interest rate of \( i \) compounded monthly, a payment of 5000 at the end of two years together with a payment of 10,000 at the end of four years have a total present value of 9375. Using the same interest rate, a deposit of 27,000 accumulates to \( Y \) after six years. Determine \( Y \).

   (A) 36,000
   (B) 48,000
   (C) 64,000
   (D) 72,000
   (E) 81,000
5. An account credits interest using $\delta_t = k \cdot \frac{t}{t^2 + 2}$ where $t$ is the number of years after January 1, 2017. A deposit of $X$ made on January 1, 2017, accumulates to $3X$ on January 1, 2021. Determine the accumulated value of this deposit on July 1, 2019.

(A) 2.01$X$

(B) 2.03$X$

(C) 2.05$X$

(D) 2.07$X$

(E) 2.09$X$

6. An account credits interest using a simple interest rate of 5%. Determine $i_5$, the annual effective interest rate for year 5.

(A) 4.2%

(B) 4.3%

(C) 4.4%

(D) 4.5%

(E) 4.6%
7. A single deposit of \( X \) is made into an account that credits interest using a simple discount rate of \( d \) over a 10-year period. At the end of 3 years, the amount in the account is 1000, whereas at the end of 5 years, the amount in the account is 1100. Calculate \( d \).

   (A) 2%
   (B) 3%
   (C) 4%
   (D) 5%
   (E) 6%

8. A deposit of 1000 is made into account A, which credits interest using a simple interest rate of 12%. At the same time, a deposit of 1000 is made into account B, which credits interest using a quarterly effective discount rate of 2%. Let \( T \) denote the time at which the forces of interest in the two accounts are equal. If \( \alpha \) and \( \beta \) denote the amounts in accounts A and B, respectively, at time \( T \), determine \( \alpha - \beta \).

   (A) -100
   (B) -50
   (C) 0
   (D) 50
   (E) 100
9. Determine \( \frac{d}{dd} (v^2) \).

(A) \( 2v \)

(B) \(-2v\)

(C) \(2v^3\)

(D) \(-2v^3\)

(E) none of the above

10. Given a nominal interest rate of \( i \), converted semiannually, let \( d \) denote the equivalent nominal discount rate, converted semiannually. Determine \( d \) in terms of \( i \).

(A) \( d = \frac{i}{1+i} \)

(B) \( d = \frac{2i}{1+i} \)

(C) \( d = \frac{2i}{1+2i} \)

(D) \( d = \frac{2i}{2+i} \)

(E) none of the above